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<b>(21) International Application Number:</b> PCT/US00/11089 <b>(22) International Filing Date:</b> 20 April 2000 (20.04.00)  <b>(30) Priority Data:</b> 60/130,900 23 April 1999 (23.04.99) US 09/379,777 24 August 1999 (24.08.99) US  <b>(71) Applicant:</b> KIMBERLY-CLARK WORLDWIDE, INC. [US/US]; 401 N. Lake Street, Neenah, WI 54956 (US).  <b>(72) Inventors:</b> KRZYSIK, Duane, Gerard; 1112 East Melrose Avenue, Appleton, WI 54911 (US); NELSON, Brenda, Marie; 3124 South Huckleberry Lane, Appleton, WI 54915 (US); LANGE, Beth, Anne; 415 South Olde Oneida, #319, Appleton, WI 54911 (US); OTTS, David, Roland; 809 North Kensington Drive, Appleton, WI 54915 (US).  <b>(74) Agents:</b> CHARLIER, Patricia, A. et al.; Kimberly-Clark Worldwide, Inc., 401 N. Lake Street, Neenah, WI 54956 (US).		<b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
<b>(54) Title:</b> ABSORBENT TISSUES PROVIDING SKIN BARRIER ENHANCEMENT  <b>(57) Abstract</b>  A skin barrier-enhancing tissue product, such as facial tissue, bath tissue or paper towels and the like, can be made by applying, on the surface(s) of the tissue, a lipid-enriched melted oil based-hydrophobic composition comprising a natural fat or oil, a sterol or sterol derivative, an emulsifying surfactant having an HLB range from about 3 to about 6, a humectant, an emollient, a wax, and a viscosity enhancer, and thereafter resolidifying the composition to form a distribution of solid composition on the surface(s) of the tissue.		

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# **Absorbent Tissues Providing Skin Barrier Enhancement**

## **Field of the Invention**

5           The present invention relates to the inclusion of a lipid-enriched hydrophobic lotion on absorbent tissue products, such as facial tissue, bath tissue, paper towels, and the like. More particularly, the present invention relates to the enhancement of skin barrier function by the delivery of oil based-hydrophobic compositions from the absorbent tissue products to the skin.

## **Background of the Invention**

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The stratum corneum is the outer-most layer of the skin and is responsible for regulating skin water levels and functioning as a barrier against chemicals and other stressors found in the environment. The complex arrangement of lipids in the intercellular space of the stratum corneum is responsible for the establishment of normal barrier function.

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Multi-layered structures of cholesterol, ceramides, and fatty acids, as well as some other minor lipids, provide the major barrier to the transport of hydrophilic substances into the or through the skin. The link between the barrier function and skin health is apparent from the skin inflammation caused by lipid extraction from the skin.

20

Skin barrier can be damaged due to a number of mechanisms. Physical abrasion, for example caused by the repeated rubbing of absorbent tissue products on the skin, strips away layers of the skin and thus damages skin barrier. Biological fluids, such as urine, feces, nasal and vaginal secretions, may contain a variety of components that can damage skin barrier. Examples of these components include proteases, lipases, bile acids, and fatty acids. Once the skin barrier is compromised, these components, in addition to other constituents of biological fluids, can initiate or exacerbate skin inflammation.

25

Excessive hydration also has a negative impact on skin barrier. Frequent contact of the skin with fluids such as nasal secretion can contribute to increased skin hydration.

30 Increased skin hydration disrupts skin lipid organization in the stratum corneum. This disruption may increase the skin permeability of irritants, thus increasing the risk of skin inflammation.

Absorbent tissue products such as facial tissue and bath tissue have been used to  
35 absorb body fluids and leave the skin dry. Absorbent tissue, in addition to absorbing fluids, however, also abrade the skin during use and frequently do not leave the skin completely dry and free of the body fluid the tissue is trying to absorb. During frequent nose-blowing or perianal wiping, for example, the skin can become so abraded as to appear red and be sore to the touch. To reduce skin abrasion, tissue additive formulations can be applied to the  
40 tissue such that, in use, the additive formulation either provides lubricity causing the tissue to glide across the surface of the skin, or leaves the tissue and is deposited on the skin.

Once deposited on the skin, these additive formulations provide a skin benefit by occluding the skin. Thus, these formulations provide a short-term benefit by providing an  
45 artificial barrier, even though the underlying stratum corneum is still damaged.

Thus, what is needed in the art is formulation chemistry that, when applied from an absorbent tissue, enhances the skin's barrier function by delivering lipid chemistry while minimizing the physical damage caused by the rubbing of the said absorbent tissue on the  
50 skin surface.

### **Summary of the Invention**

55 It has now been discovered that a skin barrier-enhancing absorbent tissue product can be made applying, on the tissue, an oil based-hydrophobic composition comprising a natural fat or oil, a sterol or sterol derivative, a humectant, an emulsifying surfactant having an HLB range from about 3 to about 6, an emollient, a wax, and optionally a viscosity enhancer, and thereafter resolidifying the composition to form a distribution, preferably a uniform distribution,  
60 of solid deposits on the surface(s) of the tissue. Because the composition is a solid at room temperature and rapidly solidifies after deposition, it has less tendency to penetrate and migrate into the sheet. Compared to tissues treated with liquid formulations, this leaves a

greater percentage of the added anhydrous solid lotion composition on the surface of the tissue where it can contact and transfer to the user's skin to provide enhanced skin health benefits. Furthermore, a lower add-on amount can be used to deliver the same benefit at a lower cost because of the efficient placement of the composition substantially at the surface of the product.

Hence, in one aspect, the present invention is an oil based-hydrophobic composition comprising from about 0.1 to about 95 weight percent natural fats or oils, from about 0.1 to about 10 weight percent sterols or sterol derivatives, from about 0.5 to about 20 weight percent of humectant, from about 1 to about 20 weight percent of water-in-oil emulsifying surfactant having an HLB range from about 3 to about 6, from about 5 to about 95 weight percent emollient, from about 5 to about 95 weight percent wax, and optionally from about 0 to about 25 weight percent viscosity enhancer. The composition may have a melting point from about 30 °C. to about 100 °C. and a process viscosity of greater than about 50 centipoise. Also, the composition may have a penetration hardness of from about 5 millimeters to 360 millimeters.

In another aspect, the invention resides in a tissue or towel product wherein one or both of the outer surfaces of the product have solidified deposits of an oil based-hydrophobic composition comprising from about 0.1 to about 95 weight percent natural fats or oils, from about 0.1 to about 10 weight percent sterol or sterol derivative, from about 0.5 to about 20 weight percent of humectant, from about 1 to about 20 weight percent of water-in-oil emulsifying surfactant having an HLB range from about 3 to about 6, from about 5 to about 95 weight percent emollient, from about 5 to about 95 weight percent wax, and optionally from about 0 to about 25 weight percent viscosity enhancer. The composition may have a melting/freezing point of from about 30 °C. to about 100 °C. and a process viscosity of greater than about 50 centipoise. Also, the composition may have a penetration hardness from about 5 millimeters of penetration to 360 millimeters of penetration.

In another aspect, the invention resides in a method of making a tissue or towel product comprising: (a) heating a composition that enhances skin barrier comprising a natural fat or oil, a sterol or sterol derivative, humectant, a water-in-oil emulsifying surfactant having an HBL range from about 3 to about 6, an emollient, a wax, and optionally a viscosity

enhancer, to a temperature above the melting point of the composition, causing the composition to melt; (b) uniformly applying the melted composition to one or both surfaces of the tissue or towel web in spaced-apart deposits; and (c) resolidifying the deposits of the melted composition. The composition may have a melting point ranging from about 30 °C. to about 100 °C.

### **Detailed Description of the Invention**

One embodiment of the present invention is a tissue or towel product having two outer surfaces. One or both outer surfaces of the product have solidified deposits of a composition that enhances skin barrier. The composition may comprise from about 0.1 to about 95 weight percent of natural fats or oils, from about 0.1 to about 10 weight percent of sterols or sterol derivatives, from about 1 to about 20 weight percent of water-in-oil emulsifying surfactant having an HLB range from about 3 to about 6, from about 0.5 to about 20 weight percent of humectant, from about 5 to about 95 weight percent of emollient, from about 5 to about 95 weight percent of wax, and from about 0 to about 25 weight percent of viscosity enhancer.

The composition may have a melting point from about 30 °C to about 100 °C. The composition may have a penetration hardness of from about 5 millimeters to about 360 millimeters. The add-on amount of the composition is from about 0.5 to about 30 weight percent based on the weight of said product. The add-on amount of the composition may also be expressed as from about 0.1 grams per meter squared ( $\text{g/m}^2$ ) to about 30  $\text{g/m}^2$  of the tissue or towel product, and more preferably from about 0.5  $\text{g/m}^2$  to about 25  $\text{g/m}^2$ .

The natural fat or oil used in the composition may include sunflower oil, borage oil, or avocado oil. The sterol or sterol derivative used in the composition may include soy sterol, cholesterol, or lanasterol. The humectant used in the composition may include glycerin, sorbitol, or starch hydrolysate. The emulsifying surfactant used in the composition may include sorbitan oleate, sorbitan trioleate or sorbitan stearate. The emollient used in the composition may include petrolatum, mineral oil, or stearyl alcohol. The wax used in the composition may include cerasin, ozokerite, or microcrystalline wax. The viscosity enhancer used in the composition may include ethylene/vinyl acetate copolymer or polyethylene.

Another embodiment of the present invention is a method of making a tissue or towel product having two outer surfaces comprising: (a) heating a composition that enhances skin barrier comprising a natural fat or oil, sterol or sterol derivative, a humectant, an emulsifying surfactant having an HLB range from about 3 to about 6, an emollient, a wax, and viscosity enhancer, to a temperature above the melting point of the composition, causing the composition to melt; (b) applying the melted composition to one or both surfaces of a tissue or towel web in spaced-apart deposits; and, (c) resolidifying said deposits of the melted composition.

The composition may have a melting point of from about 30 °C to about 100 °C. The resolidified composition may have a penetration hardness of from about 5 to about 360 millimeters. The melted composition may be applied by printing.

Another embodiment of the present invention is a skin barrier enhancing composition comprising from about 0.1 to about 95 weight percent of natural fats or oils, from about 0.1 to about 10 weight percent of sterol or sterol derivative, from about 1 to about 20 weight percent of water-in-oil emulsifying surfactant having an HLB range from about 3 to about 6, from about 0.5 to about 20 weight percent of humectant, from about 5 to about 95 weight percent of emollient, from about 5 to about 95 weight percent of wax, and from about 0 to about 25 weight percent of viscosity enhancer.

The composition may have a melting point from about 30 °C. to about 100 °C. The resolidified composition may have a penetration hardness of from about 5 millimeters to about 360 millimeters.

The natural fat or oil of the composition may be selected from the group consisting of: avocado oil, apricot oil, babassu oil, borage oil, camellia oil, canola oil, castor oil, chamomile, coconut oil, corn oil, cottonseed oil, evening primrose oil, hemp seed, hydrogenated cottonseed oil, hydrogenated palm kernal oil, maleated soybean oil, meadowfoam oil, palm kernal oil, phospholipids, rapeseed oil, palmitic acid, stearic acid, linoleic acid, rose hip oil, rose hip oil, safflower, sunflower oil, soybean oil, sweet almond, PROLIPID 141 (proprietary blend of glyceryl stearate, fatty acids, fatty alcohols, and phospholipids), or derivatives of

natural fats or oils (such as stearyl alcohol, lauryl alcohol, myristyl alcohol, and benenyl alcohol, and the like), as well as mixtures thereof. (PROLIPID is commercially available from International Specialty Products located in Wayne, New Jersey. PROLIPID is generally described in U.S. Patent No. 5,849,315 to Rerek et al. which issued December 15, 1998; which is herein incorporated by reference to the extent it is consistent herewith.)

The sterol or sterol derivative of the composition may be selected from the group consisting of: cholesterol, sitosterol, stigmasterol, ergosterol, lanasterol, soy sterol, avocado sterols, sterol esters, and the like, as well as mixtures thereof. The emulsifying surfactant of the composition may be selected from the group consisting of: sorbitan oleate, sorbitan sesquioleate, sorbitan stearate, sorbitan tristerate, sorbitan trioleate, and the like, as well as mixtures thereof.

The humectant of the composition may be selected from the group consisting of: glycerin, hydrogenated starch hydrolysate, propylene glycol, sodium PCA, sodium lactate, sorbitol, and the like, as well as mixtures thereof. The emollient of the composition may be selected from the group consisting of: mineral oil, petrolatum, stearyl alcohol, cetearyl alcohol, cetyl alcohol, behenyl alcohol, octyldodecanol, cosmetic esters, and the like, as well as mixtures thereof.

The wax of the composition may be selected from the group consisting of: carnuba, cerasin, cetyl esters, microcrystalline wax, montan wax, ozokerite, synthetic wax, and the like, as well as mixtures thereof. The viscosity enhancer of the composition may be selected from the group consisting of: polyolefins resins, polyolefin polymers, ethylene/vinyl acetate copolymers, polyethylene, and the like, as well as mixtures thereof.

The amount of the natural fats or oils used in the composition may be from about 0.1 to about 95 weight percent. The amount of the sterol or sterol derivative used in the composition may be from about 0.1 to about 10 percent. The amount of the emulsifying surfactant used in the composition may be from about 1 to about 20 weight percent. The amount of the humectant used in the composition may be from about 0.5 to about 20 weight percent. The amount of the emollient used in the composition may be from about 5 to about



95 weight percent. The amount of the wax used in the composition may be from about 5 to about 95 weight percent. The amount of the viscosity enhancer used in the composition may  
195 be from about 0 to about 25 weight percent.

One embodiment of the composition comprises about 10 weight percent sunflower oil, about 0.8 weight percent soy sterol, about 1 weight percent sorbitan oleate, about 5 weight percent glycerin, about 43.2 weight percent petrolatum, about 20 weight percent stearyl  
200 alcohol, and about 20 weight percent cerasin.

Another embodiment of the composition comprises about 10 weight percent borage oil, about 0.8 weight percent soy sterol, about 1 weight percent sorbitan oleate, about 5 weight percent glycerin, about 43.2 weight percent petrolatum, about 20 weight percent  
205 stearyl alcohol, and about 20 weight percent cerasin.

Another embodiment of the composition comprises about 10 weight percent avocado oil, about 0.8 weight percent soy sterol, about 1 weight percent sorbitan oleate, about 5 weight percent glycerin, about 43.2 weight percent petrolatum, about 20 weight percent  
210 stearyl alcohol, and about 20 weight percent cerasin.

Another embodiment of the composition comprises about 2 weight percent PROLIPID 141 (International Specialty Products, Wayne, New Jersey), about 10 weight percent sunflower oil, about 1 weight percent soy sterol, about 1 weight percent sorbitan oleate, about  
215 5 weight percent glycerin, about 32 weight percent petrolatum, about 15 weight percent behenyl alcohol, about 32 weight percent cerasin, and about 2 weight percent viscosity polyethylene.

Another embodiment of the composition comprises about 2 weight percent PROLIPID 141 (International Specialty Products, Wayne, New Jersey), about 30 weight percent sunflower oil, about 3 weight percent soy sterol, about 5 weight percent sorbitan oleate, about  
220 5 weight percent sorbitol, about 10 weight percent petrolatum, about 10 weight percent behenyl alcohol, about 30 weight percent ozokerite, and about 5 weight percent polyethylene.

225 Another embodiment of the composition comprises about 5 weight percent lanolin,  
about 20 weight percent sunflower oil, about 3 weight percent cholesterol, about 5 weight  
percent sorbitan stearate, about 5 weight percent hydrogenated starch hydrolysate, about 2  
weight percent petrolatum, about 5 weight percent octyldodecanol, about 15 weight percent  
230 stearyl alcohol, about 30 weight percent microcrystalline wax, and about 5 weight percent  
ethylene/vinyl acetate copolymer.

Another embodiment of the composition comprises about 27 weight percent avocado  
oil, about 3 weight percent avocadin or avocado sterols, about 2 weight percent sorbitan  
trioleate, about 15 weight percent glycerin, about 17 weight percent petrolatum, about 18  
235 weight percent cetyl alcohol, and about 18 weight percent cerasin.

Another embodiment of the composition comprises about 15 weight percent avocado  
oil, about 5 weight percent sterol esters, about 10 weight percent sorbitan trioate, about 8  
weight percent glycerin, about 2 weight percent petrolatum, about 55 weight percent of a  
240 blend of ozokerite and cetyl esters, and about 5 weight percent polyethylene. The blend of  
ozokerite and cetyl esters comprises about 90 weight percent ozokerite and about 10 weight  
percent cetyl esters.

Another embodiment of the composition comprises about 25 weight percent borage  
245 oil, about 10 weight percent avocadin or avocado sterols, about 5 weight percent sorbitan  
trioleate, about 1 weight percent glycerin, about 11 weight percent petrolatum, about 10  
weight percent stearyl alcohol, about 36 weight percent cerasin, and about 2 weight percent  
polyethylene.

250 Another embodiment of the composition comprises about 25 weight percent sunflower  
oil, about 3 weight percent lanasterol, about 2 weight percent sorbitan trioate, about 5  
weight percent glycerin, about 15 weight percent petrolatum, about 10 weight percent stearyl  
alcohol, about 10 weight percent behenyl alcohol, about 45 weight percent microcrystallin  
wax, and about 5 weight percent polyethylene.

255 Another embodiment of the composition comprises about 35 weight percent avocado  
oil, about 3 weight percent sitosterol about 5 weight percent sorbitan trioate, about 5 weight

percent glycerin, about 1 weight percent petrolatum, about 10 weight percent stearyl alcohol, about 21 weight percent ozokerite, and about 10 weight percent polyethylene.

260

Another embodiment of the present invention is a method for enhancing/restoring/maintaining the skin barrier function of a user. The method comprises the steps of:

- 265 a) contacting a tissue or towel product on the skin of said user wherein said material comprises a skin barrier enhancing/restoring/maintaining composition that provides a skin barrier enhancing/restoring/maintaining benefit upon transfer of the composition to the user's skin;
- b) transferring at least a portion of the composition during use of the tissue or towel product;
- 270 c) repeating steps a) and b) with one or more additional tissue or towel product with sufficient frequency to enhance/restore/maintain the skin barrier in an area of skin contacted by the tissue or towel product, relative to skin contacted by an equivalent tissue or towel product that does not comprise the skin barrier enhancing/restoring/maintaining composition.

275 The skin barrier enhancing/restoring/maintaining composition of the method comprises from about 0.1 to about 95 weight percent of natural fats or oils, from about 0.1 to about 10 weight percent of sterols and sterol derivatives, from about 1 to about 20 weight percent of water-in-oil emulsifying surfactant having an HLB range from about 3 to about 6, from about 0.5 to about 20 weight percent of humectant, from about 5 to about 95 weight percent of emollient,  
280 from about 5 to about 95 weight percent of wax, and from about 0 to about 25 weight percent of viscosity enhancer.

The composition may have a melting point from about 30 °C. to about 100 °C. The resolidified composition may have a process viscosity greater than about 50 centipoise. The  
285 resolidified composition may have a penetration hardness of from about 5 to about 360 millimeters. The method may further comprise using a tissue or towel product having a skin-barrier enhancing/restoring/maintaining composition by the user on each use occasion. The method may further comprise using a tissue or towel product which does not comprise a skin-barrier enhancing/restoring/maintaining composition by the user intermittently. The method  
290 may further comprise using the tissue or towel product comprising a skin-barrier

enhancing/restoring/maintaining composition by a user whose skin is compromised and with sufficient frequency to improve skin-barrier function.

295 The amount of a natural fat or oil or a mixture of natural fats or oils in the oil based-  
hydrophobic composition can be from about 0.1 to about 95 weight percent, more specifically  
from about 5 to about 75 weight percent, more specifically from about 10 to about 50 weight  
percent. As used herein, the phrase natural fats or oils is understood to include fats, oils,  
essential oils, fatty acids, fatty alcohols, phospholipids, and mixtures thereof. As used herein,  
suitable natural fats or oils include, but are not limited to, the following materials classified  
300 according to CTFA designations:

Fats and Oils: Apricot Kernel Oil, Avocado Oil, Babassu Oil, Borage Seed Oil, Butter, C<sub>12</sub>-C<sub>18</sub>  
Acid Triglyceride, Camellia Oil, Canola Oil, Caprylic/Capric/Lauric Triglyceride,  
Caprylic/Capric/Linoleic Triglyceride, Caprylic/Capric/Stearic Triglyceride, Caprylic/Capric  
305 Triglyceride, Carrot Oil, Cashew Nut Oil, Castor Oil, Cherry Pit Oil, Chia Oil, Cocoa Butter,  
Coconut Oil, Cod Liver Oil, Corn Germ Oil, Corn Oil, Cottonseed Oil, C<sub>10</sub>-C<sub>18</sub> Triglycerides,  
Egg Oil, Epoxidized Soybean Oil, Evening Primrose Oil, Glyceryl Triacetyl Hydroxystearate,  
Glyceryl Triacetyl Ricinoleate, Glycosphingolipids, Grape Seed Oil, Hazelnut Oil, Human  
Placental Lipids, Hybrid Safflower Oil, Hybrid Sunflower Seed Oil, Hydrogenated Castor Oil,  
310 Hydrogenated Castor Oil Laurate, Hydrogenated Coconut Oil, Hydrogenated Cottonseed Oil,  
Hydrogenated C<sub>12</sub>-C<sub>18</sub> Triglycerides, Hydrogenated Fish Oil, Hydrogenated Lard,  
Hydrogenated Menhaden Oil, Hydrogenated Mink Oil, Hydrogenated Orange Roughy Oil,  
Hydrogenated Palm Kernel Oil, Hydrogenated Palm Oil, Hydrogenated Peanut Oil,  
Hydrogenated Shark Liver Oil, Hydrogenated Soybean Oil, Hydrogenated Tallow,  
315 Hydrogenated Vegetable Oil, Lard, Lauric/Palmitic/Oleic Triglyceride, Lanolin and Lanolin  
derivatives, Lesquerella Oil, Linseed Oil, Macadamia Nut Oil, Maleated Soybean Oil,  
Meadowfoam Seed Oil, Menhaden Oil, Mink Oil, Moringa Oil, Mortierella Oil, Neatsfoot Oil,  
Oleic/Linoleic Triglyceride, Oleic/Palmitic/Lauric/Myristic/Linoleic Triglyceride, Oleostearine,  
Olive Husk Oil, Olive Oil, Omental Lipids, Orange Roughy Oil, Palm Kernel Oil, Palm Oil,  
320 Peach Kernel Oil, Peanut Oil, Pengawar Djambi Oil, Pentadesma Butter, Phospholipids,  
Pistachio Nut Oil, Placental Lipids, Rapeseed Oil, Rice Bran Oil, Safflower Oil, Sesame Oil,  
Shark Liver Oil, Shea Butter, Soybean Oil, Sphingolipids, Sunflower Seed Oil, Sweet Almond  
Oil, Tall Oil, Tallow, Tribehenin, Tricaprin, Tricaprylin, Triheptanoin,

Trihydroxymethoxystearin, Trihydroxystearin, Triisononanoil, Triisostearin, Trilaurin,  
325 Trilinolein, Trilinolenin, Trimyristin, Trioctanoil, Triolein, Tripalmitin, Trisebacin, Tristearin,  
Triundecanoil, Vegetable Oil, Walnut Oil, Wheat Bran Lipids, Wheat Germ Oil, Zadoary Oil,  
and the like, as well as mixtures thereof.

Fatty Acids: Arachidic Acid, Arachidonic Acid, Behenic Acid, Capric Acid, Caproic Acid,  
330 Caprylic Acid, Coconut Acid, Corn Acid, Cottonseed Acid, Hydrogenated Coconut Acid,  
Hydrogenated Menhaden Acid, Hydrogenated Tallow Acid, Hydroxystearic Acid, Isostearic  
Acid, Lauric Acid, Linoleic Acid, Linolenic Acid, Linseed Acid, Myristic Acid, Oleic Acid,  
Palmitic Acid, Palm Kernel Acid, Pelargonic Acid, Ricinoleic Acid, Soy Acid, Stearic Acid, Tall  
Oil Acid, Tallow Acid, Undecanoic Acid, Undecylenic Acid, Wheat Germ Acid, and the like, as  
335 well as mixtures thereof.

Fatty Alcohols: Behenyl Alcohol, C<sub>9</sub>-C<sub>11</sub> Alcohols, C<sub>12</sub>-C<sub>13</sub> Alcohols, C<sub>12</sub>-C<sub>15</sub> Alcohols, C<sub>12</sub>-C<sub>16</sub>  
Alcohols, C<sub>14</sub>-C<sub>15</sub> Alcohols, Caprylic Alcohol, Cetearyl Alcohol, Cetyl Alcohol, Coconut  
Alcohol, Decyl Alcohol, Hydrogenated Tallow Alcohol, Lanolin Alcohol, Lauryl Alcohol,  
340 Myristyl Alcohol, Oleyl Alcohol, Palm Alcohol, Palm Kernel Alcohol, Stearyl Alcohol, Tallow  
Alcohol, Tridecyl Alcohol, and the like, as well as mixtures thereof.

Essential Oils: Anise Oil, Balm Mint Oil, Basil Oil, Bee Balm Oil, Bergamot Oil, Birch Oil,  
Bitter Almond Oil, Bitter Orange Oil, Calendula Oil, California Nutmeg Oil, Caraway Oil,  
345 Cardamom Oil, Chamomile Oil, Cinnamon Oil, Clary Oil, Cloveleaf Oil, Clove Oil, Coriander  
Oil, Cypress Oil, Eucalyptus Oil, Fennel Oil, Gardenia Oil, Geranium Oil, Ginger Oil,  
Grapefruit Oil, Hops Oil, Hyptis Oil, Indigo Bush Oil, Jasmine Oil, Juniper Oil, Kiwi Oil, Laurel  
Oil, Lavender Oil, Lemongrass Oil, Lemon Oil, Linden Oil, Lovage Oil, Mandarin Orange Oil,  
Matricaria Oil, Musk Rose Oil, Nutmeg Oil, Olibanum, Orange Flower Oil, Orange Oil,  
350 Patchouli Oil, Pennyroyal Oil, Peppermint Oil, Pine Oil, Pine Tar Oil, Rose Hips Oil,  
Rosemary Oil, Rose Oil, Rue Oil, Sage Oil, Sambucus Oil, Sandalwood Oil, Sassafras Oil,  
Silver Fir Oil, Spearmint Oil, Sweet Marjoram Oil, Sweet Violet Oil, Tar Oil, Tea Tree Oil,  
Thyme Oil, Wild Mint Oil, Yarrow Oil, Ylang Ylang Oil, and the like, as well as mixtures  
thereof.

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The preferred natural oils include, but not limited to: Avocado Oil, Apricot Oil, Babassu Oil, Borage Oil, Camellia oil, Canola oil, Castor Oil, Coconut oil, Corn Oil, Cottonseed Oil, Evening Primrose Oil, Hydrogenated Cottonseed Oil, Hydrogenated Palm Kernal Oil, Maleated Soybean Oil, Meadowfoam Oil, Palm Kernal Oil, Phospholipids, Rapeseed Oil, Palmitic Acid, Stearic Acid, Linoleic Acid, Rose Hip Oil, Sunflower Oil, Soybean Oil, PROLIPID 141 (proprietary blend of Glyceryl Stearate, Fatty Acids, Fatty Alcohols, and Phospholipids from International Specialty Products, Wayne, New Jersey), derivatives of natural fats or oils (such as Stearyl Alcohol, Lauryl Alcohol, Myristyl Alcohol, Benenyl Alcohol, and the like), and the like, as well as mixtures thereof.

The amount of a sterol or sterol derivative or mixture of sterols or sterol derivatives in the oil based-hydrophobic composition can be from about 0.1 to about 10 weight percent, more specifically from about 0.5 to about 5 weight percent, and still more specifically from about 0.8 to about 1 weight percent. As used herein, suitable sterols and sterol derivatives include, but are not limited to, the following materials:  $\beta$ -sterols having a tail on the 17 position and having no polar groups, for example cholesterol, sitosterol, stigmasterol, and ergosterol, as well as  $C_{10}$ - $C_{30}$  cholesterol/lanosterol esters, cholecalciferol, cholesteryl hydroxystearate, cholesteryl isostearate, cholesteryl stearate, 7-dehydrocholesterol, dihydrocholesterol, dihydrocholesteryl octyldecanoate, dihydrolanosterol, dihydrolanosteryl octyldecanoate, ergocalciferol, tall oil sterol, soy sterol acetate, lanasterol, soy sterol, avocado sterols, sterol esters, and the like, and sourced from natural extracts (such as avocadin and lanolin, and the like), as well as mixtures thereof.

The amount of water-in-oil emulsifying surfactant/surfactant combinations having an HLB range from about 3 to about 6 in the oil based-hydrophobic composition can be from about 1 to about 20 weight percent, more specifically from about 2 to about 10 weight percent, and still more specifically from about 3 to about 8 weight percent. Emulsifying surfactants are employed typically in cosmetic preparations to form emulsions of various components. The immiscible phase, such as water and water soluble/dispersible materials, is dispersed as droplets in the continuous phase, such as an oil.

The preferred surfactants include, but are not limited to: Sorbitan monooleate, glyceryl stearate, sorbitan sequeioleate, sorbitan trioleate, sorbitan stearate, sorbitan tristearate, and the like, as well as mixtures thereof.

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The amount of humectant in the oil based-hydrophobic composition can be from about 0.5 to about 20 weight percent, more specifically from about 1 to about 15 weight percent, and still more specifically from about 3 to about 10 weight percent. Humectants are typically cosmetic ingredients used to increase the water content of the tip layers of the skin. This group of materials includes primarily hygroscopic ingredients. As used herein, suitable humectants include, but are not limited to, the following materials: Acetamide MEA, Aloe Vera Gel, Arginine PCA, Chitosan PCA, Copper PCA, Corn Glycerides, Dimethyl Imidazolidinone, Fructose, Glucamine, Glucose, Glucose Glutamate, Glucuronic Acid, Glutamic Acid, Glycereth-7, Glycereth-12, Glycereth-20, Glycereth-26, Glycerin, Honey, Hydrogenated Honey, Hydrogenated Starch Hydrolysate, Hydrolyzed Corn Starch, Lactamide MEA, Lactic Acid, Lactose Lysine PCA, Mannitol, Methyl Gluceth-10, Methyl Gluceth-20, PCA, PEG-2 Lactamide, PEG-10 Propylene Glycol, Polyamino Sugar Condensate, Potassium PCA, Propylene Glycol, Propylene Glycol Citrate, Saccharide Hydrolysate, Saccharide Isomerate, Sodium Aspartate, Sodium Lactate, Sodium PCA, Sorbitol, TEA-Lactate, TEA-PCA, Urea, Xylitol, and the like, as well as mixtures thereof.

The preferred humectants include, but are not limited to: Glycerin, Hydrogenated Starch Hydrolysate, Propylene glycol, Sodium PCA, Sodium Lactate, Sorbitol and the like, as well as mixtures thereof.

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The amount of emollient in the oil based-hydrophobic composition may be from about 5 to about 95 weight percent, more specifically from about 15 to about 80 weight percent, and still more specifically from about 20 to about 65 weight percent. As used herein, suitable emollients include, but are not limited to, the following materials: mineral oil, mineral jelly, petrolatum, cosmetic esters (isopropyl palmitate, isopropyl myristate, isopropyl adipate, C<sub>12</sub>-C<sub>14</sub> benzoate, stearyl benzoate, behenyl benzoate, octyl palmitate and the like), glyceryl esters, alkoxylated carboxylic acids, alkoxylated alcohols, fatty alcohols (lauryl alcohol, myristyl alcohol, cetyl alcohol, stearyl alcohol, ceateryl alcohol, behenyl alcohol, octyl dodecanol, and

the like), lanolin and lanolin derivatives, natural oils, base oils, silicones, organofunctional silicones, hydrogenated vegetable oils, and the like, as well as mixtures thereof.

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The preferred emollients include, but are not limited to: Mineral Oil, Petrolatum, cosmetic esters, fatty alcohols and the like, as well as mixtures thereof.

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The amount of wax in the oil based-hydrophobic composition can be from about 5 to about 95 weight percent, more specifically from about 10 to about 75 weight percent, and still more specifically from about 20 to about 60 weight percent. As used herein, suitable waxes include, but are not limited to, the following materials: natural and synthetic waxes, such as bayberry wax, beeswax, C<sub>30</sub> alkyl dimethicone, candelilla wax, carnuaba, ceresin, setyl esters, hydrogenated cottonseed oil, hydrogenated jojoba oil, hydrogenated jojoba wax, hydrogenated microcrystalline wax, hydrogenated rice bran wax, japan wax, jojoba butter, jojoba esters, jojoba wax, lanolin wax, microcrystalline wax, mink wax, montan acid wax, montan wax, ouricury wax, ozokerite, paraffin, PEG-6 beeswax, PEG-8 beeswax, rice bran wax, shellac wax, spent grain wax, steryl dimethicone synthetic beeswax, synthetic candelilla wax, synthetic carnuba wax, synthetic japan wax, synthetic jojoba wax, synthetic wax, and the like, as well as mixtures thereof.

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The preferred waxes include but are not limited to: carnuba, cerasin, cetyl esters, microcrystalline wax, montan wax, ozokerite, synthetic wax, and the like, as well as mixtures thereof.

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Optionally, the amount of viscosity enhancer in the oil based-hydrophobic composition can be from about 0 to about 25 weight percent, more specifically from about 5 to about 20 weight percent, and still more specifically from about 10 to about 15 weight percent. As used herein, suitable viscosity enhancers include, but are not limited to, the following materials: the group consisting of polyolefins resins, polyolefin polymers, ethylene/vinyl acetate copolymers, polyethylene and the like, as well as mixtures thereof.

450

Resolidification of the melted oil based-hydrophobic composition can occur almost instantaneously, without the need for external cooling means such as chill rolls, if the composition is heated to a temperature only slightly above or at the melting point of the



composition. However, external means such as chill rolls, either before or after the application of melt, can be used if desired to accelerate resolidification. Such instantaneous resolidification tends to impede penetration of the composition into the tissue and retain it on the surface of the tissue, which is advantageous. For example, the temperature of the melted composition can advantageously be above the melting point about 10 °C. or less, more specifically about 5 °C. or less and still more specifically about 2 °C. or less. As the temperature of the melted composition approaches the melting point, the viscosity of the melted composition generally increases, which further enhances the tendency of the melted composition to be retained on the surface.

For purposes herein, "melting point" is the temperature at which the majority of the melting occurs, it being recognized that melting actually occurs over a range of temperatures. The melting point of the compositions of this invention can be from about 30 °C. to about 100 °C., more specifically from about 40 °C. to about 90 °C., and still more specifically from about 50 °C. to about 70 °C.

In addition, for purposes herein, "penetration hardness" is the needle penetration in millimeters according to ASTM D 1321, "Needle Penetration of Petroleum Waxes. Lower needle penetration hardness values correspond to harder materials. The penetration hardness of the compositions of this invention can be from about 5 to 360 millimeters, more specifically from about 5 to about 200 millimeters, more specifically from about 5 to about 150 millimeters, and still more specifically from about 5 to about 100 millimeters. (Formulations having a needle penetration hardness greater than 360 millimeters cannot be measured using ASTM method D 1321).

The hardness of the formulations of this invention is important for two reasons. First, the softer the formulation the more mobile the formulation will be, making the formulation more likely to migrate to the inner plies of the tissue, which is not desirable. Secondly, softer formulations tend to be more greasy/oily to the touch, which is also less desirable. In general, formulations having a needle penetration hardness of from about 200 to 360 millimeters feel creamy to slightly greasy with less smoothness (depending on additives). Formulations that have needle penetration hardness values of from about 5 to about 200 millimeters feel silky to creamy and very smooth (depending on additives).

485       The melt point viscosity and/or the process temperature viscosity of the formulations  
or compositions of this invention is important for two reasons: First, the higher the melt point  
viscosity or the process temperature viscosity as it is applied to the outside surface of the  
diaper liner, the formulation is less likely to penetrate through to the inner ply(s) of the tissue.  
The less formulation penetrates through the tissue, the more there is on the surface of the  
490       tissue where it can readily transfer to the users skin surface. Secondly, the higher the  
viscosity of the formulation above or at the melting point of the formulation, the less likely the  
formulation will migrate at typical or adverse storage conditions.

          In order to better enhance the benefits to consumers, additional ingredients can be  
495       used. The classes of ingredients and their corresponding benefits include, without limitation:  
antiacne actives (a drug product used to reduce the number of acne blemishes, acne  
pimples, blackheads, and whiteheads); antifoaming agents (reduce the tendency of foaming  
during processing); antimicrobial actives; antifungal actives; antiseptic actives; antioxidants  
(product integrity to prevent oxidation of the natural oils or other formulation ingredients);  
500       astringents - cosmetic (induce a tightening or tingling sensation on skin); astringent - drug (a  
drug product which checks oozing, discharge, or bleeding when applied to skin or mucous  
membrane and works by coagulating protein); biological additives (enhance the performance  
or consumer appeal of the product including vitamins); colorants (impart color to the  
product); deodorants (reduce or eliminate unpleasant odor and protect against the formation  
505       of malodor on body surfaces); emollients (help to maintain the soft, smooth, and pliable  
appearance of the skin by their ability to remain on the skin surface or in the stratum corneum  
to act as lubricants, to reduce flaking, and to improve the skin's appearance); film formers (to  
hold active ingredients on the skin by producing a continuous film on skin upon drying);  
fragrances (consumer appeal); natural moisturizing agents (NMF) and other skin  
510       moisturizing ingredients known in the art; skin conditioning agents; skin exfoliating agents  
(ingredients that increase the rate of skin cell turnover such as alpha hydroxy acids and beta  
hydroxyacids); skin protectants (a drug product which protects injured or exposed skin or  
mucous membrane surface from harmful or annoying stimuli); solvents (liquids employed to  
dissolve components found useful in the cosmetics or drugs); sunscreens (ingredients that  
515       absorb at least 85 percent of the light in the UV range at wavelengths from 290 to 420  
nanometers, but transmit UV light at wavelengths longer than 420 nanometers); and,

surfactants (as cleansing agents, solubilizing agents, suspending agents, and wetting agents).

520 The total tissue add-on of the composition can be from about 0.5 to about 40 weight percent, more specifically from about 5 to about 30 weight percent, and more specifically from about 10 to about 15 weight percent, based on the weight of the tissue. The add-on amount will depend upon the desired effect of the composition on the product attributes and the specific composition. A preferred method to uniformly apply the heated composition to  
525 the surface of the tissue web is rotogravure printing, either direct or indirect (offset), because it is a more precise exact printing process and offers maximum control of the composition distribution and transfer rate. However, other printing methods, but not limited to, flexographic printing or spraying such as WEKO, can be used.

530 As used herein, all recited ranges of amounts, temperatures, molecular weights and penetration hardnesses are intended to include all sub-ranges within the recited ranges, even though not specifically stated.

The compositions of the present invention may be applied to the entire outer  
535 surface(s) of the tissue or towel product or portions thereof. The compositions of the present invention may be applied non-uniformly to the outer surface of the tissue or towel product. The term "non-uniformly", as used herein, refers to the amount, pattern of distribution, thickness of the application, areas of non-coverage, or the like, for which the composition can be varied over the outer surface(s) of the tissue or towel product.

540

Also as used herein, a "tissue product" can be a facial tissue, bath tissue, paper towel, dinner napkin or the like. The tissue products of this invention can be one-ply, two-ply, three-ply or more. In all cases, the composition is applied to one or both outer surfaces of the product after the product has been dried. The composition can be applied after the plies are  
545 brought together or prior to bringing the plies together. The individual plies can be layered or blended (homogeneous) creped or uncreped, throughdried or wet-pressed.

**Examples**

550

The following examples are presented to provide a more detailed understanding of the invention. The particular materials and parameters are exemplary and are not intended to limit the scope of the invention.

555 The following formulas are used in Examples 1-4.

**Formula 1                      weight percent**

560 Petrolatum                      93.7%  
Glycerin                      5%  
PROLIPID 141                      1.0%  
(International Specialty Products, Wayne, NJ)  
Tocopherol acetate                      0.3%

**Formula 2                      weight percent**

565 Petrolatum                      88.7%  
Glycerin                      5%  
PROLIPID 141                      1.0%  
(International Specialty Products, Wayne, NJ)  
Tocopherol acetate                      0.3%  
570 Avocadin (CRODA)                      5.0%

**Formula 3                      weight percent**

575 Petrolatum                      83.7%  
Glycerin                      5%  
Tocopherol acetate                      0.3%  
Sunflower oil                      9.2%  
Soy sterol                      0.8%  
PROLIPID 141 (ISP)                      1.0%  
(International Specialty Products, Wayne, NJ)

580

**Formula 4                      weight percent**

Petrolatum                      100%

**Formula 5                      weight percent**

585 Petrolatum                      85.4%  
Glycerin                      5%  
Glyceryl monoleate                      3%  
Borage oil                      3%  
Soy sterol                      3%  
590 Aloe                      0.3%  
Tocopherol acetate                      0.3%

**Formula 6**                      **weight percent**

595	Petrolatum	86.4
	Glycerin	5%
	Glyceryl monoleate	3%
	Borage oil	3%
	Soy sterol	1%
600	PROLIPID 141(ISP)	1.0%
	(International Specialty Products, Wayne, NJ)	
	Aloe	0.3%
	Tocopherol acetate	0.3%

**Formula 7**                      **weight percent**

605	Petrolatum	44%
	Mineral oil	10.8%
	Cerasin	10%
	Stearyl alcohol	25%
	Isopropyl palmitate	3%
610	Sunflower oil	3%
	Soy sterol	3%
	Dimethicone	1%
	Aloe Extract	0.1%
615	Vitamin E acetate	0.1%

**Formula 8**                      **weight percent**

	Petrolatum	36%
	Mineral oil	10.8%
	Cerasin	10%
620	Stearyl alcohol	25%
	Glycerin	5%
	Glyceryl mono-oleate	3%
	Isopropyl palmitate	3%
	Sunflower oil	3%
625	Soy sterol	3%
	Dimethicone	1%
	Aloe Extract	0.1%
	Vitamin E acetate	0.1%

630

**Example 1**

Lipid-enriched formulations for treatment of absorbent tissue promote barrier repair as measured by TEWL.

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All studies were conducted in a temperature and humidity controlled room ( $71^{\circ} \pm 5^{\circ} \text{ F}$ ;  $40\% \pm 5\%$  relative humidity).

#### Transepidermal water loss (TEWL)

The volar forearm of 24 panelists was abraded by an emery cloth to increase TEWL levels to 18-20 g/m<sup>2</sup>h. After abrasion, fifteen microliters of a lipid-enriched formulation was topically applied to the volar forearm. TEWL measurements were obtained using a Dermalab evaporimeter instrument at 1, 2, and 4 hours. Mean TEWL values are expressed in Table 1.

Repeated measures ANOVA was used to adjust for the repeated TEWL measures.

Table 1: TEWL (g/m<sup>2</sup>/hr) Results- Lipid-enriched absorbent tissue formulations

	PIR Mean	1 Hour Mean	2 Hour Mean	4 Hour Mean
Formula 1	19.8	6.6 *	6.6 *	7.9 *
Formula 2	18.3	6.4 *	6.6 *	7.3 *
Formula 3	19.2	6.5 *	6.5 *	7.1 *
Untreated	19.2	15.2	14.3	14.3

\* denotes significantly different than untreated site.

The above data clearly demonstrates that the lipid-enriched formulations improve skin barrier repair.

#### Example 2

Lipid-enriched formulations for treatment of absorbent tissue enhance skin moisturization as measured by conductance.

All studies were conducted in a temperature and humidity controlled room ( $71^{\circ} \pm 5^{\circ} \text{ F}$ ;  $40\% \pm 5\%$  relative humidity).

#### Conductance

Fifteen microliters of lipid-enriched formulation for an absorbent tissue was topically applied to the volar forearm. Conductance measurements were obtained using the Skicon

665 instrument at 1, 2, 4, and 6 hours. Mean conductance values are expressed in Table 2. A pair-wise comparison for each time period using univariate ANOVAs was applied.

Table 2: Conductance- Lipid-enriched formulations for absorbent tissues

	Baseline Mean	1 Hour Mean	2 Hour Mean	4 Hour Mean	6 Hour Mean
Formula 1	202	370*	357*	335*	310*
Formula 2	220	344*	349*	333*	319*
Formula 3	220	342*	340*	333*	320*
Untreated	200	220	235	232	223

\* denotes significantly different than untreated site.

670 The above data clearly demonstrates that the lipid-enriched formulations improve skin barrier moisturization.

### 675 Example 3

Lipid-enriched formulations for treatment of absorbent tissue enhance skin moisturization as measured by conductance.

680 All studies were conducted in a temperature and humidity controlled room ( $71^{\circ} \pm 5^{\circ} \text{ F}$ ;  $40\% \pm 5\%$  relative humidity).

#### Conductance

685 Fifteen microliters of a lipid-enriched absorbent tissue formulation was topically applied to the volar forearm. Conductance measurements were obtained at 1, 2, 4, and 6 hours. Mean conductance values for the baseline, 4, and 6 hour timepoints are expressed in Table 3. A pair-wise comparison for each time period using univariate ANOVAs was applied.

690

Table 3: Conductance- Absorbent tissue formulations

	Baseline Mean	4 Hour Mean	6 Hour Mean
Formula 4	187	243	247
Formula 5	179	281*	289*
Formula 6	195	295*	297*
Untreated	194	210	215

\* denotes significantly different than untreated site.

The above data clearly demonstrates that the lipid-enriched formulations improve skin barrier moisturization.

#### Example 4

Repetitive wiping with an absorbent tissue treated with a hydrophobic lipid-enriched formula reduces barrier damage compared to an untreated absorbent tissue

Absorbent tissue treated with a hydrophobic lipid-enriched formula was repetitively wiped on the side of the face to determine the extent of barrier damage as measured by TEWL. The study consisted of repetitively wiping the face of 10 panelists with the absorbent tissues for a total of 15 wiping cycles. The wiping cycles were timed to be approximately 30 minutes apart with each wiping cycle consisting of 20 wipes. A baseline TEWL reading and TEWL readings after every two wiping cycles were obtained for each panelist using the Dermalab evaporimeter. The change in TEWL between wiping cycles was determined for each treatment.

<i>Treatment</i>	<i>Estimated increase in TEWL/ wiping cycle</i>
Absorbent tissue treated with formula 7	4.2*
Absorbent tissue treated with formula 8	4.3*
non-treated absorbent tissue	6.4

\*denotes statistically different than non-treated absorbent tissue

Repetitive wiping with the absorbent tissues treated with the lipid-enriched hydrophobic formulas resulted in less skin barrier damage compared to the untreated absorbent tissue.



Thus, the Examples representatively illustrate that the lipid-enriched hydrophobic composition of the present invention may provide absorbent tissue products having improved softness as well as providing improved protection of the skin barrier function. Accordingly, the different aspects of the present invention can advantageously provide absorbent tissue products which, when compared to conventional tissue products, are softer and have improved protection of skin barrier function. Such absorbent tissue products can advantageously be used for absorbent tissue products, such as facial tissue, bath tissue, paper towels, and the like.

While the invention has been described in detail with respect to the specific aspects thereof, it will be appreciated that those skilled in the art, upon attaining an understanding of the foregoing, may readily conceive of alterations to, variations of, and equivalents to these aspects. Accordingly, the scope of the present invention should be assessed as that of the appended claims and any equivalents thereto.

**We claim:**

1. A tissue or towel product having two outer surfaces, wherein one or both outer surfaces of said product have a composition that enhances skin barrier comprising:
  - from about 0.1 to about 95 weight percent of natural fats or oils;
  - from about 0.1 to about 10 weight percent of sterols or sterol derivatives;
  - 735 from about 1 to about 20 weight percent of water-in-oil emulsifying surfactant having an HLB range from about 3 to about 6;
  - from about 0.5 to about 20 weight percent of humectant;
  - from about 5 to about 95 weight percent of emollient;
  - from about 5 to about 95 weight percent of wax; and,
  - 740 from about 0 to about 25 weight percent of viscosity enhancer.
2. The product of Claim 1, wherein said composition has a melting point from about 30 °C to about 100 °C.
3. The product of Claim 1, wherein said composition has a penetration hardness of from about 5 millimeters to about 360 millimeters.
4. The product of Claim 1, wherein the add-on amount of said composition is from about 0.5 to about 30 weight percent based on the weight of said product.
5. The material of Claim 1, wherein the add-on amount of said composition is from about 0.1 grams per meter squared ( $\text{g/m}^2$ ) to about 30  $\text{g/m}^2$  of said material.
6. The product of Claim 1, wherein said natural fat or oil is sunflower oil.
7. The product of Claim 1, wherein said natural fat or oil is borage oil.

- 8.** The product of Claim 1, wherein said natural fat or oil is avocado oil.
- 9.** The product of Claim 1, wherein said sterol or sterol derivative is soy sterol.
- 10.** The product of Claim 1, wherein said sterol or sterol derivative is cholesterol.
- 11.** The product of Claim 1, wherein said sterol or sterol derivative is lanasterol.
- 12.** The product of Claim 1, wherein said humectant is glycerin.
- 13.** The product of Claim 1, wherein said humectant is sorbitol.
- 14.** The product of Claim 1, wherein said humectant is hydrogenated starch hydrolysate.
- 15.** The product of Claim 1, wherein said emulsifying surfactant is sorbitan oleate.
- 16.** The product of Claim 1, wherein said emulsifying surfactant is glyceryl stearate.
- 17.** The product of Claim 1, wherein said emulsifying surfactant is sorbitan stearate.
- 18.** The product of Claim 1, wherein said emollient is petrolatum.
- 19.** The product of Claim 1, wherein said emollient is mineral oil.
- 20.** The product of Claim 1, wherein said emollient is stearyl alcohol.
- 21.** The product of Claim 1, wherein said wax is cerasin.

**22.** The product of Claim 1, wherein said wax is ozokerite.

**23.** The product of Claim 1, wherein said wax is microcrystalline wax.

**24.** The product of Claim 1, wherein said viscosity enhancer is ethylene/vinyl acetate copolymer.

**25.** The product of Claim 1, wherein said viscosity enhancer is polyethylene.

**26.** A method of making a tissue or towel product having two outer surfaces comprising:

- (a) heating a composition that enhances skin barrier comprising a natural fat or oil, sterol or sterol derivative, a humectant, an emulsifying surfactant having an HLB range from about 3 to about 6, an emollient, a wax, and viscosity enhancer, to a temperature above the melting point of said composition, causing said composition to melt; (b) applying said melted composition to one or both surfaces of a tissue or towel web; and, (c) resolidifying said melted composition.

**27.** The method of Claim 26, wherein said has a melting point of from about 30 °C to about 100 °C.

**28.** The method of Claim 26, wherein said resolidified composition has a penetration hardness of from about 5 to about 360 millimeters.

**29.** The method of Claim 26, wherein said melted composition is applied by printing.

**30.** A skin barrier enhancing composition comprising from about 0.1 to about 95 weight percent of natural fats or oils, from about 0.1 to about 10 weight percent of sterol or sterol derivative, from about 1 to about 20 weight percent of water-in-oil emulsifying surfactant with

an HLB range from about 3 to about 6, from about 0.5 to about 20 weight percent of humectant, from about 5 to about 95 weight percent of emollient, from about 5 to about 95 weight percent of wax, and from about 0 to about 25 weight percent of viscosity enhancer.

**31.** The composition of Claim 30, wherein said composition has a melting point from about 30 °C. to about 100 °C.

**32.** The composition of Claim 30, wherein said resolidified composition has a penetration hardness of from about 5 millimeters to about 360 millimeters.

**33.** The composition of Claim 30, wherein said natural fat or oil is selected from the group consisting of: avocado oil, apricot oil, babassu oil, borage oil, camellia oil, canola oil, castor oil, chamomile, coconut oil, corn oil, cottonseed oil, evening primrose oil, hemp seed, hydrogenated cottonseed oil, hydrogenated palm kernal oil, maleated soybean oil, meadowfoam oil, palm kernal oil, phospholipids, rapeseed oil, palmitic acid, stearic acid, linoleic acid, rose hip oil, safflower, sunflower oil, soybean oil, sweet almond, or derivatives of natural fats or oils such as stearyl alcohol, lauryl alcohol, myristyl alcohol, and benenyl alcohol, and mixtures thereof.

**34.** The composition of Claim 30, wherein said sterol or sterol derivative is selected from the group consisting of: cholesterol, sitosterol, stigmasterol, ergosterol, lanasterol, soy sterol, avocado sterols, sterol esters, and mixtures thereof.

**35.** The composition of Claim 30 wherein said sterol is selected from natural extracts that contain sterols or sterol derivatives selected from the group consisting of: lanolin, avocadin, and mixtures thereof.

**36.** The composition of Claim 30, wherein said emulsifying surfactant is selected from the group consisting of: sorbitan oleate, sorbitan sesquioleate, glyceryl stearate, sorbitan stearate, sorbitan tristerate, sorbitan trioleate, and mixtures thereof.

- 37.** The composition of Claim 30, wherein said humectant is selected from the group consisting of: glycerin, hydrogenated starch hydrolysate, propylene glycol, sodium PCA, sodium lactate, sorbitol, and mixtures thereof.
- 38.** The composition of Claim 30, wherein said emollient is selected from the group consisting of: mineral oil, petrolatum, stearyl alcohol, cetearyl alcohol, cetyl alcohol, behenyl alcohol, octyldodecanol, cosmetic esters, and mixtures thereof.
- 39.** The composition of Claim 30, wherein said wax is selected from the group consisting of: caruba, cerasin, cetyl esters, microcrystalline wax, montan wax, ozokerite, synthetic wax, and mixtures thereof.
- 40.** The composition of Claim 30, wherein said viscosity enhancer is selected from the group consisting of: polyolefins resins, polyolefin polymers, ethylene/vinyl acetate copolymers, polyethylene, and mixtures thereof.
- 41.** The composition of Claim 30, wherein the amount of said natural fats or oils is from about 0.1 to about 95 weight percent.
- 42.** The composition of Claim 30, wherein the amount of said sterol or sterol derivative is from about 0.1 to about 10 percent.
- 43.** The composition of Claim 30, wherein the amount of said emulsifying surfactant is from about 1 to about 20 weight percent.
- 44.** The composition of Claim 30, wherein the amount of said humectant is from about 0.5 to about 20 weight percent.

**45.** The composition of Claim 30, wherein the amount of said emollient is from about 5 to about 95 weight percent.

**46.** The composition of Claim 30, wherein the amount of said wax is from about 5 to about 95 weight percent.

**47.** The composition of Claim 30, wherein the amount of said viscosity enhancer is from about 0 to about 25 weight percent.

**48.** A method for enhancing/restoring/maintaining skin barrier function skin of a user, comprising the steps of:

- a) contacting a tissue or towel product on said skin of said user wherein said product comprises a skin barrier enhancing/restoring/maintaining composition that provides a skin barrier enhancing/restoring/maintaining benefit upon transfer of said composition to said user's skin;
- b) transferring at least a portion of said composition during use of said tissue or towel product; and,
- c) repeating steps a) and b) with one or more additional tissue or towel product with sufficient frequency to enhance/restore/maintain said skin barrier in an area of skin contacted by said liner or tissue material, relative to skin contacted by an equivalent tissue or towel product that does not comprise said skin barrier enhancing/restoring/maintaining composition,

wherein said skin barrier enhancing/restoring/maintaining composition comprises: from about 0.1 to about 95 weight percent of natural fats or oils, from about 0.1 to about 10 weight percent of sterols and sterol derivatives, from about 1 to about 20 weight percent of water-in-oil emulsifying surfactant having an HLB range from about 3 to about 6, from about 0.5 to about 10 weight percent of humectant, from about 5 to about 95 weight percent of emollient, from about 5 to about 95 weight percent of wax, and from about 0 to about 25 weight percent of viscosity enhancer.

**49.** The method of Claim 48, wherein said composition having a melting point from about

30°C. to about 100°C.

**50.** The method of Claim 48, wherein said resolidified composition has a process viscosity greater than about 50 centipoise.

**51.** The method of Claim 48, wherein said resolidified composition has a penetration hardness of from about 5 to about 360 millimeters.

**52.** The method of Claim 48, wherein said tissue or towel product comprising said skin-barrier enhancing/restoring/maintaining composition are used by said user on each use occasion.

**53.** The method of Claim 48, wherein said tissue or towel product which do not comprise a skin-barrier enhancing/restoring/maintaining composition are used by said user intermittently.

**54.** The method of Claim 48, wherein said tissue or towel product comprising said skin-barrier enhancing/restoring/maintaining composition are used by a user whose skin is compromised and are used with sufficient frequency to improve skin-barrier function.



# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 00/11089

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61K7/48

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

CHEM ABS Data, EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 690 821 A (J. SMITH ET AL.) 1 September 1987 (1987-09-01) the whole document	1
X	WO 99 13861 A (THE PROCTER & GAMBLE CO.) 25 March 1999 (1999-03-25) the whole document	1
X	WO 99 12519 A (THE PROCTER & GAMBLE CO.) 18 March 1999 (1999-03-18) the whole document	1
-/-		

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents:

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- \*E\* earlier document but published on or after the international filing date
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- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search

12 September 2000

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# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 00/11089

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DATABASE CHEMICAL ABSTRACTS 'Online! STN; abstract 102: 172 431, XP002147160 abstract &amp; JP 59 227816 A (KAO CORP.) 21 December 1984 (1984-12-21)</p>	1

# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/US 00/11089

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4690821 A	01-09-1987	NONE	
WO 9913861 A	25-03-1999	AU 8745598 A EP 1011630 A ZA 9808057 A	05-04-1999 28-06-2000 17-02-1999
WO 9912519 A	18-03-1999	AU 8642598 A EP 1011629 A ZA 9807944 A	29-03-1999 28-06-2000 05-03-1999
JP 59227816 A	21-12-1984	JP 1454815 C JP 63002531 B	25-08-1988 19-01-1988